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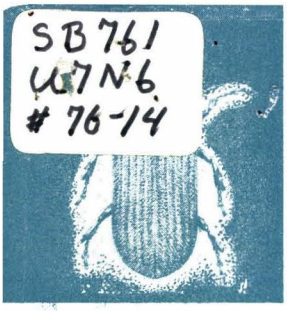

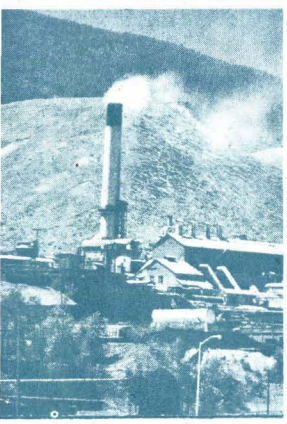

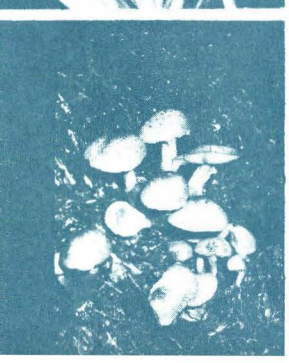

FOREST ENVIRONMENTAL PROTECTION

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GUIDELINES FOR DWARF MISTLETOE CONTROL IN LODGEPOLE PINE IN THE NORTHERN AND CENTRAL ROCKY MOUNTAINS

by

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ABSTRACT

The lodgepole pine type commonly occurs as an even-aged, single-storied, and overstocked forest. Dwarf mistletoe is widespread throughout the type and causes growth and quality reduction, reduced seed production, and some direct mortality. The land manager has three alternatives where dwarf mistletoe occurs: (1) do nothing, (2) eradicate the stand, or (3) reduce the infestation to a tolerable level. The nature of the disease as an obligate parasite with a restricted potential for spread provides an excellent opportunity for effective control by removal of infected trees as an integral part of silvicultural management.

INTRODUCTION

The lodgepole pine type commonly occurs as an even-aged, single-storied and overstocked forest. This situation develops when the proper combination of fire, seed, and climatic conditions favor the successful establishment of a large number of seedlings. However, other single to multi-storied stands representing one or more age groups frequently occur as a result of natural or man-caused factors.

1/ Plant pathologists, Northern and Rocky Mountain Regions, respectively.

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ROCKY MOUNTAIN STATION

Dwarf mistletoe (*Arceuthobium americanum* Nutt. ex Engel.) is widespread throughout the lodgepole pine type and exerts an impact on productivity through tree mortality, growth and quality reduction, and reduced seed production. Infested stands can yield acceptable volumes if proper control methods are used. Dwarf mistletoe can be controlled by removal of infected trees as an integral part of silvicultural management. The presence of dwarf mistletoe will have different implications in determining proper silvicultural prescriptions depending on stand structure, site index, and severity of infection.

The inherent nature of the disease as an obligate parasite with a restricted potential for spread gives an excellent opportunity for effective control at a modest investment. A definite correlation exists between site index and severity of infection (Alexander, 1975). Higher levels of infection are generally associated with the poorer sites. Trees of different crown classes are also affected differently depending on site quality. For example, when the site index is 70 or greater, only the middle and lower crowns of dominants and codominants develop heavy infection; while trees in the intermediate and lower crown classes become heavily infected throughout their crowns. When site index is below 70, generally all crown classes become heavily infected throughout their crowns.

In Colorado and Wyoming, dwarf mistletoe has an altitudinal limit from 300 to 500 feet below the commercial limits of lodgepole pine (Hawksworth, 1956). The absence of the disease on these areas simplifies the management situation.

MANAGEMENT OBJECTIVES

Management objectives of National Forests include the reduction of losses from forest insects and diseases (FSM 2483.3). Increased growth rate and improved quality of timber are usually the primary objectives when dwarf mistletoe control is considered.

ADMINISTRATIVE FRAMEWORK

Dwarf mistletoe prevention and suppression should be carried out as an integrated part of appropriate timber management operations, not as independent disease control projects. This will mean that:

1. Prevention and suppression guides will be developed by the Regional Pathologist for inclusion in Regional Supplements to FSM 2400.

2. Prevention and suppression should be performed principally as a part of timber sales, reforestation projects, and stand improvement projects.

3. Prevention and suppression will be financed primarily with KV and P&M funds on Federal lands and with State timber funds on State lands.

4. The Regional Pathologist will provide professional guidance.

5. The Regional Pathologist and RO or SO Timber Management Staff will train and assist National Forests and States in dwarf mistletoe control and will inspect for compliance with the Regional policy.

Prevention, detection, evaluation, and suppression work financed with I&DC funds will be carried out or directed by the Regional or State Pathologist.

SILVICULTURAL PRESCRIPTION

The land manager needs a complete description of stand age, structure, stocking, and site index, along with dwarf mistletoe intensity and distribution to assist in preparing the silvicultural prescription.

If the silvicultural prescription is a regeneration cut, the land manager is responsible for timely removal of the dwarf mistletoe-infested overwood to prevent or minimize infection of the new crop (FSM 2405.22). Any regeneration cutting method is satisfactory if all overstory trees are removed within 10 years after the new stand is established.

If the prescription calls for weeding, cleaning, or thinning, these activities must incorporate any necessary dwarf mistletoe control work (FSM 2476.03). In this case, computer program LPMREV can help the land manager determine the best combination of management options that will produce the greatest return on his investment. For many young stands yield projections show that one stand entry, usually a precommercial thinning, will produce acceptable yields.

LPMREV is a modification of SWYLD2, a computer program for preparing simulated yield tables in dwarf mistletoe-infested ponderosa pine stands (Edminster and Hawksworth, 1976). The equations in the program will apply only to the analyses of even-aged stands. The stand must be relatively uniform in species composition, tree density, dwarf mistletoe distribution, site quality, and past treatment. Stands of any size may be analyzed since the yield tables give values for an average acre.

EFFECT OF SILVICULTURAL TREATMENT ON SPREAD AND INTENSIFICATION

Regeneration cuts.--Practical prevention of dwarf mistletoe infestation in the new stand requires complete removal of all infected trees over an area of at least 20 acres or in strips at least 200 feet wide. Each infected overstory tree left after cutting provides enough dwarf mistletoe seed to infest a circle of regeneration with a radius of about a chain. If one infected tree per acre is left, much of the regeneration will eventually become heavily infected.

Clearcutting

Clearcutting is the best way to prevent dwarf mistletoe infection in the regeneration. Units should be regular in shape; narrow strips should be avoided. The units should be no smaller than 20 acres to keep the proportion of the area within one-half chain of the boundary small (Figure 1). One-half chain is the distance within which more than 90 percent of dwarf mistletoe seed is dispersed (Hawksworth and Graham, 1963).

The land manager should utilize natural barriers such as rocky ridgetops, stream bottoms, and type changes for timber sale boundaries where possible. In addition, the land manager should plan to remove or move back infected boundaries through subsequent sales at the earliest opportunity.

Partial cutting

The land manager must use partial cutting practices where the maintenance of a continuous forest cover is required. Partial cutting generally produces ideal conditions for intensification and subsequent damage by the parasite. When dwarf mistletoe is present in stands where partial cutting is proposed, the following cutting modifications are recommended (Alexander, 1975).

1. Cut only in stands where the average mistletoe rating in the six-class infection system (Figure 2) is Class 2 or less. (Individual tree ratings are averaged to obtain the value for the stand). In single-storied stands, where site index is 70 or above, trees in the intermediate and lower crown classes should be removed in preference to dominants and codominants. If site index is below 70, trees in all crown classes are about equally susceptible to infection. In two- and three-storied stands, as much of the cut as possible should come from the lower stories because these trees are likely to be more heavily infected. To minimize infection of new reproduction in single-, two-, and three-storied stands, the final overstory removal should be made

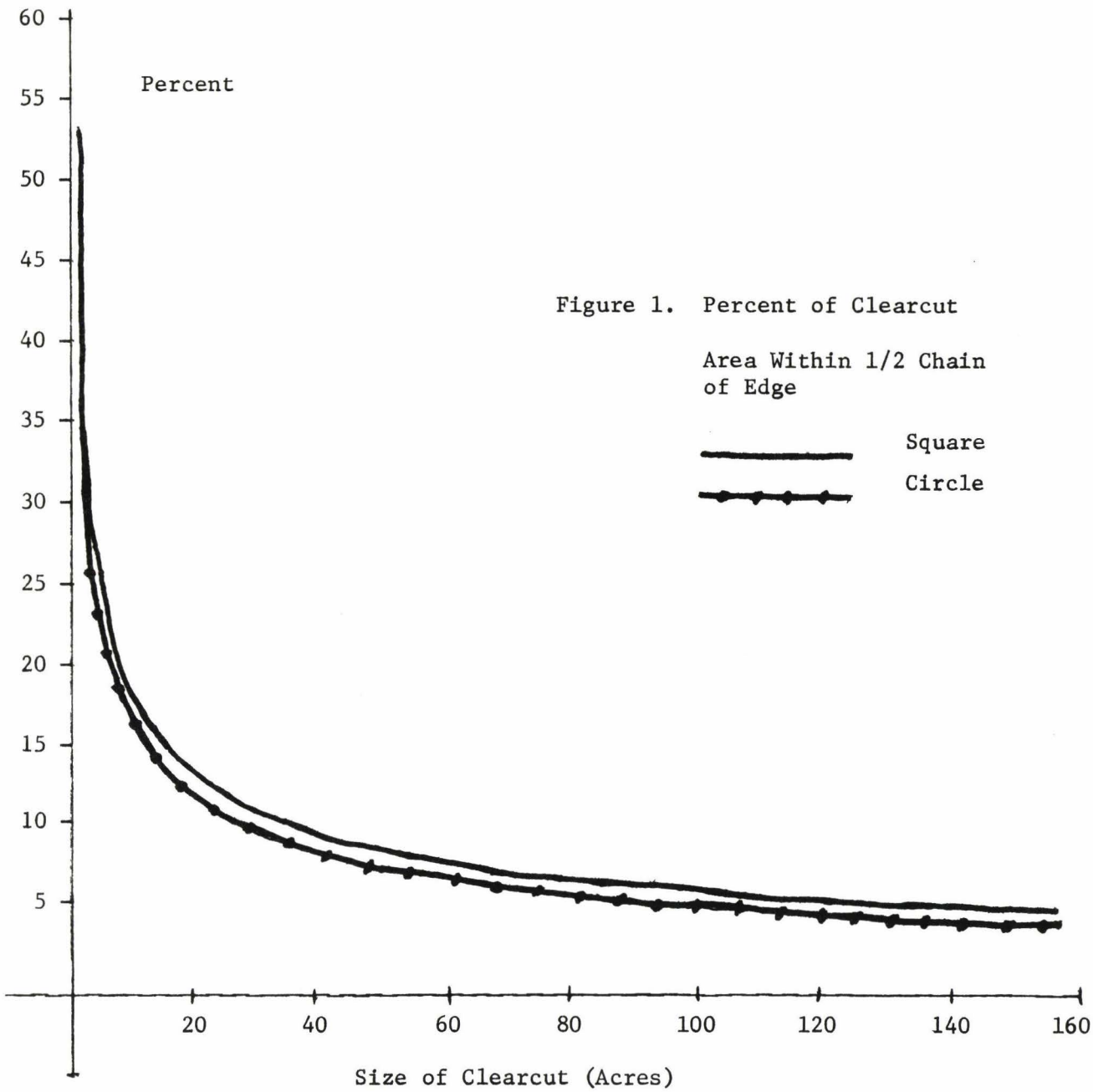


Figure 1. Percent of Clearcut Area Within 1/2 Chain of Edge

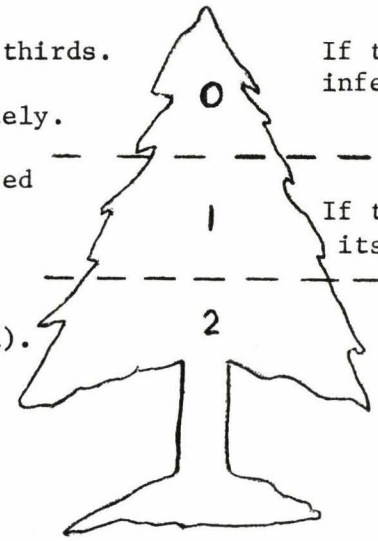
INSTRUCTIONS

STEP 1. Divide live crown into thirds.

STEP 2. Rate each third separately. Each third should be given a rating of 0, 1 or 2 as described below.
(0) No visible infections.
(1) Light infection (1/2 or less of total number of branches in the third infected).
(2) Heavy infection (more than 1/2 of total number of branches in the third infected).

STEP 3. Finally, add ratings of thirds to obtain rating for total tree.

EXAMPLE



If this third has no visible infections, its rating is (0).

If this third is lightly infected, its rating is (1).

If this third is heavily infected, its rating is (2).

The tree in this example will receive a rating of 0 + 1 + 2 = 3.

Figure 2.--The 6-class mistletoe rating system (Hawksworth 1961).

within 20 years of the regeneration cut when the average mistletoe rating is Class 1, or 10 years when the rating is Class 2. After the final cut, the young stand should be evaluated to determine any need for treatment. In multi-storied stands, the safest procedure is an overwood removal with a cleaning and thinning from below.

2. In old-growth stands with an average mistletoe rating greater than Class 2, any partial cutting, thinning, or cleaning is likely to intensify the infection. The best procedure, therefore, is to either remove all of the trees and start a new stand or leave the stand uncut. If the manager chooses to make a partial cut for any reason, the initial harvest should be heavy enough to be a regeneration cut. All residual trees must be removed within 10 years after the first cut.

Weeding and thinning.--Weeding and thinning are cultural methods used to release crop trees from competition and accelerate their growth rate. These methods will have varying effects on dwarf mistletoe infection depending on how and when they are applied and the condition of each stand. Most stands with an average dwarf mistletoe rating of Class 2 or less will benefit from treatment and produce acceptable yields.

Tree density and intensity of dwarf mistletoe are two key factors that determine the feasibility of thinning. Stands with heavier stocking levels can tolerate higher levels of dwarf mistletoe and still produce acceptable yields. For infested stands of pre-commercial age, more favorable management options are available when stand densities exceed 1,000 trees per acre. By utilizing LPMREV, the land manager can select the appropriate silvicultural treatment for each stand and rank them by priority.

CONTROL ALTERNATIVES

No control.--Conduct normal management activities; any reduction in the incidence of dwarf mistletoe is incidental and not a planned action. This is a viable alternative where:

1. Less than 10 percent of the stand is infected. Normal thinning activities will keep infection levels low enough to ensure good growth.

2. Removal of all Class 3 and higher trees would result in an understocked stand.

3. Management activity is not feasible until a commercial entry can be made and the unmerchantable portion of the stand destroyed after product removal.

4. The lodgepole pine currently on the area is the last generation. The stand is converting to climax.

Complete control.--Completely destroy heavily infested young stands, or remove all trees over 1 foot in height from clearcut stands or burned-over areas. This is a viable alternative where:

1. A young stand is so heavily infested that a commercial harvest cannot be realized within one normal rotation (90 to 120 years).

2. The stand has recently been clearcut, but some unmerchantable infected whips are still present.

3. The stand has been burned within the past 10 years but not all infected trees were killed by the fire or removed in salvage operations.

Partial control.--Reduce infection to levels that do not seriously affect timber production by removing all overstory trees and all Class 3 and higher trees in the understory during combined thinning/sanitation. This is a viable alternative where:

1. The stand is less than 50 percent infected and an infested overstory was or is present.

2. The stand has been regenerated by a shelterwood or seed tree cut and the infected seed trees have not been removed.

3. The stand was burned-over more than 10 years ago, regeneration has occurred, and an infested overstory is present.

BIOLOGICAL PRIORITIES

Within the following priorities, the better site indices should be given higher priority because of the greater potential volume growth.

First.--Recent burns (within 10 years).

Second.--Recent clearcuts (within 10 years).

Third.--Shelterwood or seed tree removal from regenerated stands (within 20 years).

Fourth.--Overstory removal and/or thinning/sanitation in stands under 20 years old, including burns and clearcuts between 10 and 20 years old with infested overstory.

Fifth.--Same, stands over 20 years old. Infection should not exceed 50 percent at 30 years of age.

Benefit/cost priorities would be in a reverse order to the biological priorities because the older stands would usually produce an economic return much sooner than the younger stands.

FINANCING

Needs.--A considerable amount of dwarf mistletoe control is accomplished during regular silvicultural treatments without increased costs. At other times, there will be an additional cost to achieve the desired level of control.

Source.--Expenditure of K-V funds is authorized for removal of infested overstory and understory from timber sale areas prior to planting or seeding. K-V funds can be used for dwarf mistletoe control coincidental to cultural operations on completed sale areas when it is

necessary to increase growth or improve the quality of reproduction and young growth residuals (FSM 2477.1).

I&DC funds may be used only for the removal of an infected non-merchantable overstory from a stand that meets these criteria:

1. Other funds are not available.

2. A silvicultural examination has been made and a prescription written.

3. A biological evaluation shows:

   a. Infection level in overstory.

   b. Distribution of infected overstory.

   c. Infection level in understory.

   d. Deadline for control operations before area must be dropped into next lower priority.

Presence or absence may be adequate statement in evaluation.

4. A favorable benefit/cost ratio shown using LPMREV or alternative methods, including resources other than timber.

5. An environmental analysis made.

6. A narrative project work plan written and a project proposal (5200-10) completed.

7. A priority assigned by the Forest and Region.

BENEFIT/COST

Dwarf mistletoe control should not normally be conducted unless the benefit/cost ratio is greater than 1.00.

Benefits derived from control practices can be estimated from either data in the LPMREV yield tables or potential yield from silvicultural handbooks. Merchantable volumes at various times in the future can be valued at current market levels and then discounted back to the present at 10 percent to determine their present net worth. The present net worth divided by current treatment cost gives the benefit/cost ratio of control. This ratio is based only on the primary resource value, and should not include value added to the economy in wages and social benefits at the time of each stand entry.

Quantify the benefits to resources other than timber if possible. If these cannot be quantified, a narrative statement should be written for the project.

ENVIRONMENTAL IMPACT

Dwarf mistletoe control is accomplished in conjunction with regular silvicultural practices. Some adverse impacts are normally associated with these practices, but dwarf mistletoe control would not cause additional ones.

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